

Stardust now on its Wild(-2) ride

Spacecraft in excellent health after Feb. 7 launch

JPL's Stardust spacecraft successfully shot into a clear blue sky atop a Delta II rocket from Florida's Cape Canaveral Air Station at 1:04:15 p.m. PST on Feb. 7 to become the first U.S. mission destined for a comet, and the first-ever spacecraft sent to bring a sample of a comet sample back to Earth.

Launch occurred following a 24-hour postponement due to a problem with telemetry data from a radar beacon on the Delta launch vehicle used to track the rocket as it ascends.

The Stardust team reported that the spacecraft was in excellent health and that its power and temperature levels were normal. The spacecraft is in communication with NASA's Deep Space Network, and is controlled through the mission operations area at Lockheed Martin Astronautics in Denver and monitored at JPL.

It's great to have the "voyage" begun,

Billows of exhaust fill Launch Pad 17-A, Cape Canaveral Air Station, as the Boeing Delta II rocket carrying the Stardust spacecraft heads for Comet Wild-2. After a 24-hour postponement, the spacecraft lifted off at 1:04 p.m.



KENNEDY SPACE CENTER PHOTO

said Stardust Project Manager Dr. Kenneth Atkins. "After the launch, Don Brownlee (Stardust's principal investigator, a professor at the University of Washington) and I made a 'pilgrimage' back to the launch pad. It was impressive to see that place where so much

See Stardust, page 5

MGS successfully completes aerobraking

By MARY HARDIN

JPL's Mars Global Surveyor spacecraft will soon begin its primary mapping mission after it successfully fired its main rocket engine early on Feb. 4 and raised its orbit completely out of the Martian atmosphere to end the aerobraking phase of the mission.

The burn was executed at 12:11 a.m. Pacific time when the flight team determined that the farthest point in the spacecraft's orbit had dropped to 450 kilometers (280 miles) above the Martian surface. The spacecraft's closest approach to Mars then slowly drifted south until it moved into a circular Sun-synchronous orbit, in which the spacecraft crossed the Martian equator at about 2 a.m. local solar time.

"The use of aerobraking has been a pioneering operation for a spacecraft at Mars, and we now know that we can use this technique with confidence for future Mars missions," said Glenn E. Cunningham, deputy director of the Mars Exploration Program at JPL. "It has been a long and arduous task that has turned into a valuable learning experience for all of us—engineer and scientist alike. The flight team has done a superb job and we're really glad the aerobraking phase of the mission is now successfully behind us. We're looking forward to beginning the primary mapping mission."

The start of the primary mapping mission has been delayed by about a year due to a structural problem with the spacecraft's solar panel that required the flight team to take a more cautious approach to aerobraking to ensure that the weakened panel was not overstressed.

During one full Martian year (687 Earth days), Mars Global Surveyor will study the planet's topography, magnetic field, mineral

See MGS, page 3

Galileo finds atmosphere on Callisto

By JANE PLATT

JPL's Galileo spacecraft has detected a thin carbon dioxide atmosphere on Jupiter's moon Callisto, and has confirmed the existence of carbon dioxide on Callisto's surface. The findings appear in the Feb. 5 issue of the journal *Science*.

This latest discovery means that all four of Jupiter's large Galilean moons—Callisto, Europa, Io and Ganymede—have some form of atmosphere.

"Callisto's atmosphere is so tenuous that the carbon dioxide particles are literally drifting around without bumping into one another," said JPL's Dr. Robert Carlson, principal investigator for Galileo's near-infrared mapping spectrometer instrument. "An atmosphere this thin is known as an exosphere."

The instrument detected the carbon dioxide

atmosphere during observations of Callisto made during the 10th orbit around Jupiter in September 1997. Carlson said he and other scientists were following up on discoveries made by Galileo upon its arrival at Jupiter's system in 1995.

The spacecraft detected what appeared to be carbon dioxide on Callisto's surface. This latest finding confirms that the surface chemical was, in fact, carbon dioxide, and that the chemical also appears in the atmosphere above Callisto.

"An atmosphere this thin is easily lost due to ultraviolet radiation from the Sun, which breaks the molecules into ions and electrons that are swept away by Jupiter's magnetic field," Carlson said. "For us to find such an atmosphere implies that there is a steady flux of carbon dioxide into the atmosphere. Venting of gas

See Galileo, page 3

Special Events Calendar

Ongoing

Alcoholics Anonymous—Meets at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. Call Occupational Health Services at ext. 4-3319.

Codependents Anonymous—Meets at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. Call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6948.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. Call (626) 397-3110.

Friday, February 19

Travel Film—"China: The Middle Kingdom" will be shown at 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$9 and \$7. For information, call (626) 395-4652.

Von Kármán Lecture Series—Dr. Michael Klein, manager of the Deep Space Network Science Office, will discuss "Science and Communications, Billions of Miles Away," at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Fri., Feb. 19–Sat., Feb. 20

Caltech Glee Clubs—The men's and women's clubs will together present a program featuring "Songs of War and Love" at 8 p.m. in Caltech's Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Fri., Feb. 19–Sun., Feb. 21

"Richard III"—Shakespeare's tragedy will be presented by Theater Arts at Caltech in the campus' Ramo

Auditorium at 7:30 p.m. Friday and Saturday, 3 p.m. Sunday. Tickets are \$15. Call (626) 395-4652.

Sunday, February 21

Chamber Music—The Tokyo String Quartet will perform in Caltech's Beckman Auditorium at 3:30 p.m. Tickets are \$25, \$21, \$17 and \$13. For information, call (626) 395-4652.

Wednesday, February 24

Apple Update—Ron Ustach, a senior system engineer with Apple Computers, will talk about what's new from Apple. Topics to be covered include the new Power Macintosh G3 desktops, the MacOS X Server, Apple OpenGL and Quicktime Technologies. At noon in von Kármán Auditorium. Information from the presentation will be available online at <http://icis.jpl.nasa.gov/iis/library/newtalks.htm>.

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. For more information, contact Mary Sue O'Brien at ext. 4-5090.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. Call Joyce Wolf at ext. 4-7361.

Thursday, February 25

Caltech Architectural Tour—The Caltech Women's Club presents this free service, which is open to the public. The tour begins at 11 a.m. and lasts about 1 1/2 hours. Meet at the Athenaeum front hall, 551 S. Hill, Pasadena. For information and reservations, call Susan Lee at (626) 395-6327.

JPL Golf Club—Meeting at noon in Building 306-302.

Poetry Lecture—Irish Nobel laureate Seamus Heaney will give a free talk at 8 p.m. in Caltech's Beckman Auditorium. For information, call (626) 395-4652.

Friday, February 26

"An Evening With Langston and Martin"—Danny Glover and Felix Justice will present an evening of theatrical readings from the works of Langston Hughes and Dr. Martin Luther King Jr. At 8 p.m. in Caltech's Beckman Auditorium. Tickets are \$35, \$31 and \$27. Call (626) 395-4652.

Folk Music—"Fiddlin' on the Old Frontier," featuring country and bluegrass, will be presented at 8 p.m. in Caltech's Dabney Lounge. Tickets are \$12. Call (626) 395-4652.

Fri., Feb. 26–Sun., Feb. 28

"Richard III"—Shakespeare's tragedy will be presented by Theater Arts at Caltech in the campus' Ramo Auditorium at 7:30 p.m. Friday and Saturday, 3 p.m. Sunday. Tickets are \$15. Call (626) 395-4652.

Tuesday, March 2

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, March 3

Associated Retirees of JPL/Caltech Board—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

JPL Drama Club—Meeting at noon in Building 301-127.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previ-

ous study of the language is essential. Call Joyce Wolf at ext. 4-7361.

"Supercomputing Simulations: A New Tool For Science and Engineering"—Theoretical physics professor Dr. Steven Koonin will provide this free lecture at 8 p.m. in Caltech's Beckman Auditorium. Call (626) 395-4652.

Thursday, March 4

Caltech-Occidental Symphony Orchestra—The program for this free concert will be announced. It will be held at 8 p.m. in Caltech's Ramo Auditorium. Call (626) 395-4652.

Investment Advice—A Fidelity representative will be available for retirement and investment sessions. Call (800) 642-7131 to schedule an appointment.

JPL Gun Club—Meeting at noon in Building 183-328.

Friday, March 5

Jazz/Classical Jam Session—Fred Hersch and Jeffrey Kahane will perform piano at this 8 p.m. show in Caltech's Beckman Auditorium. Tickets are \$35, \$31 and \$27. Call (626) 395-4652.

JPL Dance Club—Meeting at noon in Building 300-217.

Sunday, March 7

Associated Retirees of JPL/Caltech—Members will take a round-trip train ride from Fillmore to Santa Paula, with lunch served onboard. The trip also includes a stop for wine tasting. Cost: \$48 per person. Call Lila Moore at (818) 790-5893.

State of Lab address March 2

JPL Director Dr. Edward Stone's annual State of the Laboratory address will be held Tuesday, March 2 at noon in von Kármán Auditorium.

Among the subjects Stone will discuss:

- The current string of JPL missions. Four of the Laboratory's "six launches in six months" are now flying—Deep Space 1, Mars Climate Orbiter,

Mars Polar Lander (also carrying Deep Space 2) and Stardust—with Wide Field Infrared Explorer (WIRE) due for launch in March and QuikScat set for this spring.

- Improved budget projections for NASA and JPL.

- New business and administrative support systems at JPL.

Stone's address will also be shown on the Laboratory's closed-circuit television system. □

WIRE prepares for launch

Origins mission set for launch March 1 or 2 from Vandenberg AFB

Final preparations are under way for the launch of NASA's Wide Field Infrared Explorer (WIRE) spacecraft, which will soon embark on a four-month mission to assemble a history of the star and galaxy formation of the universe.

As *Universe* went to press, WIRE was scheduled for launch March 1 or 2 from California's Vandenberg Air Force Base.

JPL manages the mission and provided the science instrument for the spacecraft, which was built by NASA's Goddard Space Flight Center in Maryland.

The WIRE instrument consists of a 30-centimeter aperture (12.5-inch) Cassegrain telescope with no moving parts, said WIRE principal investigator Perry Hacking. The telescope is enclosed within a two-stage, state-of-the-art, solid-hydrogen cryostat, which uses the sublimation (transition directly from solid to gas) of frozen hydrogen to cool the telescope.

The cryostat is designed like

a thermos bottle, using a vacuum space between layers of insulation to minimize heat flow to the inside. The telescope mirrors are cooled to less than 13 Kelvin (K) (-436 F) and the focal plane arrays are cooled to less than 7 K (-447 F) using only 4.5 kilograms (9.9 pounds) of solid hydrogen. The telescope must be cold so that its own infrared light doesn't overwhelm the light that it is trying to detect from space.

WIRE will concentrate its observations on starburst galaxies, luminous galaxies that are producing new stars at 10 times the rate of typical galaxies. It will also search for extremely distant ultra-luminous infrared galaxies, very energetic galaxies that are producing stars 100 times faster than typical star-forming galaxies.

WIRE will examine the remote universe to determine the large-scale distribution of galaxies, which will be used to test competing theories of galaxy evolution. WIRE is expected to detect more than 100,000 star-forming galaxies, most of which will lie more than 4 billion light-



The WIRE spacecraft is shown mounted to its Pegasus launch vehicle at California's Vandenberg Air Force Base. The first two stages are visible on the other side of a contamination barrier, and the right half of the fairing is visible in the corner behind the spacecraft.

years away.

Some of the ultraluminous galaxies will probably be many billions of light-years away, Hacking said, possibly representing the first galaxies to form.

WIRE is scheduled to inventory 100,000 galaxies within a region of the sky equal to 5,000 times the area of the full moon, or between 2 and 3 percent of the celestial sphere.

The WIRE telescope and spacecraft have recently been attached to a Pegasus rocket, from which launch will occur under the belly of a Lockheed L-1011 aircraft. The WIRE cryostat was also recently filled with

its supply of solid hydrogen coolant at Vandenberg, Hacking said.

WIRE will be carried to an altitude of approximately 11.9 kilometers (39,000 feet), at which point the Pegasus rocket will be launched and subsequently place the WIRE spacecraft into a nearly polar, circular orbit 540 kilometers (335 miles) above the Earth.

Data analysis will take place at Caltech's Infrared Processing and Analysis Center (IPAC), which is managed by JPL.

WIRE is part of NASA's Small Explorer Program, which provides

See WIRE, page 6

MGS

Continued from page 1

composition and atmosphere.

"Global Surveyor will become our first weather satellite at Mars," Cunningham said. "During the extended aerobraking phase, the spacecraft was able to acquire some 'bonus' science data that has yielded some spectacular new findings about Mars. We now have a profile of the planet's northern polar cap and information about the unique nature of its remnant magnetic fields."

During the aerobraking technique, the spacecraft uses frictional drag as it skims through the planet's thin upper atmosphere to

alter the shape of its orbit around the planet. First tested in the final days of the Magellan mission to Venus in 1994, the technique is an innovative way of changing the spacecraft's orbit while carrying less onboard fuel.

When Global Surveyor arrived at Mars in September 1997, it initially entered a looping, elliptical orbit around the planet that has been gradually circularized through aerobraking. Its winged solar panels—which feature a Kapton flap at the tip of each wing for added drag—supply most of the surface area that slowed the spacecraft by a total of more than 1,200 meters per second (about 2,700

mph) during the entire aerobraking phase. Since the start of aerobraking, Surveyor's orbit around Mars has shrunk from an initial elliptical orbit of 45 hours to the now nearly circular orbit taking less than two hours to complete.

Flight controllers are scheduled to again fire the spacecraft's main engine on Feb. 19 or 20 and perform a final "transfer to mapping orbit" burn, which will lower Global Surveyor's closest approach over Mars from 405 kilometers (250 miles) to approximately 379 kilometers (237 miles). After a short period of calibrating the science instruments, mapping will begin in early March. □

Galileo out of safe mode

JPL's Galileo spacecraft is out of safing mode and has resumed normal flight operations, including playback of pictures and other science data gathered during the Jan. 31 Europa flyby.

Four hours after that flyby, Galileo entered safing mode—a built-in protection mode designed to turn off all non-essential spacecraft activities—while the spacecraft was performing a Sun acquisition turn. The turn was halted when onboard fault protection software determined that the turn was lasting longer than it should have.

Normal operations of the spacecraft were restored Wednesday,

Feb. 10, and the playback of science data resumed the next morning. All observations made by Galileo's instruments during the close approach to Europa on Jan. 31 were successfully stored and are being transmitted to Earth. In the days after Galileo entered safing mode, scientists were unable to make planned distant observations of Europa, Io and Jupiter. □

Galileo

Continued from page 1

from the interior is one possibility, and Galileo images show surface erosion that suggests carbon dioxide outgassing."

Previous findings indicated that two of Jupiter's moons, Europa and Ganymede, have a thin oxygen atmosphere, while Io's atmosphere contains sulfur dioxide.

"We're anxious to look for other gases that may be contained in Callisto's atmosphere," Carlson said. Scientists will have that opportunity when Galileo observes Callisto during two of four flybys planned during the remainder of the current extended mission. Galileo will make observations of Callisto during encounters in May and June; it will be observing other targets during flybys of Callisto in August and September.

Those encounters will take place before the two Io flybys that will wrap up the spacecraft's extended Galileo Europa Mission, during which Galileo has flown by Europa eight times. □

Getting ready for ISO audit

By DR. JERRY SUITOR
ISO 9000 Implementation Team

The ISO 9001 registration audit is only 38 days from this issue of the *Universe*. That is not much time to get ready. Employees are asking what they can do to be ready for the DNV auditors on the week of March 29. The ISO Office has some tips for everyone.

Know the procedures that govern the work you do. Knowing the procedures includes knowing how to find any documentation related to your work quickly. Become familiar with the DMIE

Information System (IE Navigator) at <http://dmie>. Also become familiar with any project or section libraries where documents are maintained.

Second, a completed Employee Notebook is a great help in getting ready for the audit. The notebooks were distributed to all employees last fall. The sections of the notebook include a place for documents that direct your work. Other parts of the notebook are also an aid to preparing for the audit.

On audit day, be calm and don't worry. The ISO audits are really rather simple. Typical questions can be found on the ISO web site at <http://iso>. Some points to remember:

- Be helpful, courteous, and responsive.

- Be positive about JPL and the audit.

- Let the auditor ask the questions.

- Listen carefully to the auditor's question and make sure you fully understand what is being asked before you answer.

- Use your Employee Notebook. This is an open-book test.

- Limit your answers to the questions asked; don't offer additional information.

- Give clear, factual answers. (If you answer questions with "I think," auditors will question how well you understand your work process.)

- If you don't know the answer, direct the auditor to your manager or supervisor.

- Be professional and courte-

ous. (Arguing with an auditor will undermine your credibility as well as that of the organization.)

- Have your work documentation available.

- Stay confident; no one knows your job better than you.

Some popular questions include:

- Do you know the JPL Quality Policy?

- What does it mean to you?

- Where do you fit in the organization?

- What do you do?

- How are you trained for your job?

- How do you get your direction?

- What documents govern the work you do? □

New Bonus Awards provide cash to winners

The Human Resources Directorate has announced the establishment of the Bonus Awards Program, which will provide a significant number of lump-sum cash awards in recognition of JPL employees' outstanding accomplishments and behaviors.

"This is an exciting and much-anticipated addition to the current Base Pay Program and the Reward and Recognition Program," said Kathleen Hardcastle, manager of

Compensation and Benefits. "The program has been designed to recognize technical and administrative accomplishments that ensure the future success of the Laboratory."

The Bonus Awards Program consists of two awards: Outstanding Accomplishments and Outstanding Leadership.

The Outstanding Accomplishment Award recognizes significant achievements by individuals.

Examples of award criteria include adding value for the customer, technology development, managing and taking risk, process improvement, and innovation and use of new tools and methods.

The Outstanding Leadership Award recognizes accomplishments and behaviors that demonstrate a proactive approach to change. Examples of the award criteria include effective partnering, effective mentoring and

coaching, ensuring customer satisfaction, facilitating effective team behavior and ensuring mission success.

The Bonus Awards will be given based on three levels of impact on the organization: Labwide, cross-directorate and local (within directorate).

Based on the level of impact, awards range from \$500 to \$2,500.

To be eligible for an award, Labwide or cross-directorate accomplishments must occur between February and September 1999, with payout of these awards in December. The first eligibility period for local awards will be between February and April, with payout in May 1999 and ongoing thereafter.

In February and March, Levels II and III Managers will receive training on the program and the nomination and selection processes.

"In addition to the Award for Excellence, the Bonus Award Program provides another opportunity for employees who make outstanding accomplishments to receive a lump sum cash award," said Reward and Recognition Administrator Monica Garcia. "It is exciting for me to see the Bonus Awards come to fruition. This cash award will recognize those employees who are making substantial contributions ... they deserve it."

For more details and the complete description of the criteria for the Bonus Awards Program, visit the Compensation home page at <http://eis/hr/compensation>. □

Computers must be Y2K compliant by March 31

By March 31, 1999, all JPL personnel are required to ensure that their PC and Macintosh hardware and software are Year 2000 (Y2K) compliant, according to Tim Scheck, JPL Year 2000 project control and communication manager.

A "PC & Mac Compliance Testing and Sticker Procedure" to guide users through specific steps in the compliance process is now online at <http://eis.jpl.nasa.gov/jply2k/lib/Documents/Y2K000220.pdf>. The procedure covers verification of both hardware and software Y2K compliance.

Employees should also follow this procedure whenever they receive a new PC or Macintosh, Scheck said.

Hardware Testing: Users of subscribed and non-subscribed PCs should test their hardware

now for Y2K problems by using the test at <http://y2k>. Although the test has been updated, users do not need to test again if they have successfully done so already. "If you must replace your PC due to Y2K problems, make immediate arrangements to do so, as we anticipate there will be increased demand in the coming weeks," Scheck said.

Macintosh hardware does not need to be tested because it is not susceptible to the Y2K problem, he noted.

Software Verification: Later in February, users of computers subscribed to the OAODNS support package will receive an e-mail from OAODNS. It will provide instructions on how to check the Y2K compliance of the operating system and core product applications on their PC or Mac and update non-compli-

ant versions. These users should wait for this guidance, but non-core product users can check compliance of their applications and follow the manufacturers' updating recommendations at any time.

Users of non-subscribed Macs and PCs should consult the new online procedure to check the Y2K compliance of their operating system and core product applications, as well as all other applications.

All personnel should inform their organizations' Y2K representative or section designee of the results of their computer testing. They will then issue staff the appropriate sticker to indicate Y2K compliance of their computer. The list of Y2K project representatives is shown at <http://eis.jpl.nasa.gov/jply2k/lib/Documents/Y2K000092.pdf>. □

50 ninth-graders learn about Stardust and supernovas

By JOHN G. WATSON

DeAndra Blakley, 14, learned that supernovas are the deaths of stars. Jamaal Moore, 15, found out all about the intricate contingency plans that go into the sculpting of a NASA mission.

Both ninth-graders had quite a learning experience Saturday, Feb. 6, when they joined 50 other students in a visit to JPL to view live video of the scheduled launch of the Stardust mission, which will collect particles from a comet's atmosphere.

"I learned more about the universe and Earth—I didn't know what a supernova was," said Blakley.

"It really struck me how much they plan before sending those things up there," added Moore. "They have so many precautions, so many back-ups, so many ways to repair problems."

The youngsters are among 60 participants in the Maxine Waters Saturday Academy for Student Advancement in Math, Science and Communication, founded last fall to prepare socially and economically disadvantaged students to compete effectively at the college level.

Academy classes are held on Saturdays at Washington Preparatory High School at 108th Street and Denker Avenue in South Central Los Angeles, where Blakley and Moore coincidentally attend school full-time. The Academy is funded by NASA through JPL and is administered by the Los Angeles Unified School District.

The big day began with a talk by Dr. Jacklyn Green about Space Technology 4/Champollion, a proposed NASA mission to land a spacecraft on the nucleus of a comet for the first time ever, launching in 2003 and landing in 2005. Hamilton Hill, an engineer on SeaWinds/QuikScat, an Earth-orbiting mission to measure ocean winds, discussed not only that mission but also posters he's created for Black History Month depicting prominent African American scientists and engineers associated with JPL through the years.

A tour of JPL's mission control and spacecraft assembly areas was followed by discussion with Dr. Donald Yeomans, JPL's Near-Earth Objects Program Manager. He answered questions about missions to comets and asteroids and displayed a sample of aerogel, a sub-



JPL astronomer Dr. Donald Yeomans describes a model of the Stardust spacecraft and the aerogel it carries to students of the Maxine Waters Saturday Academy for Student Advancement in Math, Science and Communication.

stance with the look of translucent gelatin. This lightweight substance is made of silica and is more than 99 percent air. Stardust will use aerogel like a sponge as it travels through the atmosphere of a comet and will send its aerogel package back to Earth so scientists can analyze the cometary particles embedded in it.

"Aerogel was really fascinating for the students—they were quite intrigued by it," Yeomans said. "I was surprised to see so many young

kids at JPL on a Saturday. It speaks volumes that they're devoting their free time to the learning process."

With a gaggle of local television cameras aimed at them, the students then joined friends and family of the Stardust staff in JPL's von Kármán Auditorium to view live coverage of the mission's launch. There was just one small snag: the launch was delayed to Sunday, due to a minor radar-related problem.

But a little thing like a one-day

launch delay was hardly enough to dampen the students' high spirits. Moore, a business major, summed it all up by saying, "I really appreciate how the Academy teachers and JPL scientists and engineers are taking time to help out youth. After all, a lot of kids never have the chance to get out and see new things."

For more information about this fall's Academy classes for entering ninth graders, call (323) 242-8278. □

Stardust

Continued from page 1

of our last three and a half years of work had been just hours before—now empty. It was a moving experience."

Two very special guests attended the launch: Swiss astronomer Dr. Paul Wild, discoverer of the comet that is Stardust's destination, and American astronomer Dr. Fred Whipple, who lent his name to the Whipple shields that will protect the spacecraft from the hail of debris when Stardust collects its comet sample.

Dr. Peter Tsou, who developed the aerogel for Stardust, hosted the two visiting scientists.

About 4 minutes after separation from the Delta's third stage, Stardust's solar arrays began to unfold and pointed toward the Sun. The spacecraft's signal was successfully acquired by the NASA Deep Space Network complex in Canberra, Australia, 51 minutes after launch at 1:55 p.m. PST.

Stardust is on a flight path that will deliver it to Comet Wild-2 (pronounced "Vilt-2" on Jan. 2, 2004). The spacecraft will gather particles flying off the nucleus of the comet. In addi-

tion, Stardust will attempt to gather samples from a stream of interstellar dust that flows through the solar system.

Captured in 132 tiles of a glass foam called aerogel, the comet and interstellar dust samples will be enclosed in a clamshell-like capsule that will be dropped off for reentry into Earth's atmosphere in January 2006. Equipped with parachutes, the capsule will float to a pre-selected spot in the Utah desert, where it will be retrieved and its contents delivered to scientists at Johnson Space Center in Houston for detailed analysis. □

790 staff help support new student library

Thanks to the generosity of employees in the Space Science Flight Experiments Program 790 and its projects, a Los Angeles elementary school has received a large monetary donation to help purchase new books for its new library.

As a follow-up to participation in a career day at Western Avenue Elementary School in Los Angeles last year by Karla Miller of 790 and Don Langford of the Low Temperature Micro-gravity Physics project, the division and its projects recently supported a book drive for Western Avenue Elementary School's new library, which will open in May.

The \$300 donation to the school was presented Feb. 1 by Division 790 Manager Michael Devirian to Principal Linda Kim and Vice Principal Zolietta Jefferson.

The central-Los Angeles school will receive new books and possibly matching funds from a businesswomen's organization.

"This school was selected because its teachers and principals are dedicated to providing students with the very best opportunity



PHOTO BY JPL PHOTO LAB

to receive an excellent education and give students a vision that will guide them through high school and college," Miller said.

The \$300 total tripled Miller and Langford's original fundraising goal. The employees' donation will be acknowledged on a plaque to be dedicated at the new library's opening. □

Division 790 Manager Michael Devirian presents check of JPL employees' donations to Western Avenue Elementary School Principal Linda Kim, left, and Vice Principal Zolietta Jefferson.

Pluto again is most distant planet

By JANE PLATT

On Feb. 11, Pluto moved farther from the Sun than Neptune, regaining its status as the most distant planet in the solar system. Pluto will maintain its title of "most distant planet" for the next 228 years. Neptune had been the farthest planet for the past 20 years (since Feb. 7, 1979).

Unlike the other planets in our solar system, Pluto has a highly elliptical orbit, completing its journey around the Sun every 248 years. Thus, Pluto's distance from the Sun varies. Most of the time, Pluto is the farthest planet from the Sun, but for a short time during its orbit, Pluto was closer to the Sun than Neptune.

Why is there controversy about Pluto?

In some ways, Pluto is different than the other planets. It's much smaller than the four inner planets (Mercury, Venus, Earth and Mars) and it doesn't fit in with the four gas giant outer planets (Jupiter, Saturn, Uranus, and Neptune). Pluto's diameter is 2,300 kilometers (1,430 miles), making it less than half the size of any other planet, and only two-thirds as big as Earth's moon.

Pluto's orbit is much more tilted and elliptical than the other planets. Some scientists believe Pluto should not be called a planet at all. They feel it should be put in the same category as Kuiper Disk objects, icy worlds smaller than Pluto that lie in the "same neighborhood" as Pluto and Neptune, and even beyond. These objects may be leftover debris from our solar system's early

formation.

But Pluto is spherical and it does orbit the Sun. Although this controversy has come up on occasion, Pluto is still classified as a planet.

What else do we know about Pluto?

Pluto was discovered on Feb. 18, 1930 by Clyde Tombaugh, who studied photographic plates taken of the night sky through a Lowell Observatory telescope. Pluto's moon Charon was first found in 1978. Pluto is made from a mixture of rocky and icy material, and it appears to have seasonal changes, but we don't know much else about it.

Does NASA plan further studies of Pluto?

Observations from ground and orbiting telescopes will continue to glean some information from 4.5 billion kilometers' distance (about 2.8 billion miles).

Detailed study requires a close-up look. A mission called Pluto-Kuiper Express, managed by JPL, would fly past Pluto and its moon Charon, and study Kuiper Disk objects. The mission would launch in 2004, and would take about 10 years to reach its destination. □

WIRE

Continued from page 3

frequent flight opportunities for highly focused and relatively inexpensive space science missions.

"WIRE greatly exceeds all of its most important performance specifications, and was

King presentation available for loan

Videotapes of JPL's Martin Luther King Day celebration, held Jan. 22, are available for loan through the Audiovisual Services Office. Call ext. 4-6666.

The event included a number of guest speakers, musicians and other presentations. Among the speakers were former JPL engineer and current astronaut Stephanie Wilson, and Genethia Hudley-Hayes, executive director of the Southern Christian Leadership Conference of Greater Los Angeles. Also, Paul Ware, Caltech attorney and manager of Technology Utilization/ Patents, paid a personal tribute to King. Ware was in the same graduating class (1948) with King at Morehouse College.

Musicians included 16-year-old Justin Bahrami, a sophomore at La Cañada High School and son of Section 345 group supervisor Ted Bahrami, and popular jazz saxophonist Ron Brown. □

delivered on time and \$10 million under budget," Hacking said. "It is the first of the Small Explorers to do all three.

"The WIRE team has worked hard and we eagerly await the receipt of these exciting data," he added.

For more information about the mission, go online to <http://www.ipac.caltech.edu/swire>. □

Retirees

The following employees retired in February:

Richard Zanteson, 43 years, Section 354; **Daniel Sidwell**, 42 years, Section 320; **Malcolm MacMartin**, 39 years, Section 352; **William Layman**, 38 years, Section 350; **Donald Dahlquist**, 37 years, Section 346; **Donald Denne**, 37 years, Section 354; **Lanny Lafferty**, 37 years, Section 352; **Charles Vegas**, 36 years, Section 940; **Jack Margolis**, 32 years, Section 327; **Helmut Wilck**, 32 years, Section 331; **Johnie Driver**, 31 years, Section 314; **Donovan Spitzmesser**, 30 years, Section 335; **Reuben Ruiz**, 29 years, Section 790; **William Strombert**, 26 years, Section 389; **Ronald Bigelow**, 25 years, Section 393; **Alan Marriott**, 23 years, Section 830; **Ollie Smith**, 18 years, Section 314; **Beverly Steobe**, 18 years, Section 622; **Gerald Howell**, 17 years, Section 664; **Rollin Reynolds**, 17 years, Section 394; **Arlyn Thurman**, 17 years, Section 212; **Judy Levstik**, 16 years, Section 100; **Werner Mattson**, 15 years, Section 331; **Mary O'Connor**, 11 years, Section 214; **Myron Hitch**, 10 years, Section 665; **B. Michele Neilson**, 10 years, Section 321. □

Passings

Robert Somer, 42, manager of Institutional Business Systems' Product Implementation Office 222, died of cardiac arrest Jan. 27 at his Arcadia home.

Somer had been with JPL since 1985. He is survived by his wife, Verena Hawkins Somer.

Memorial services were held Feb. 1 at Forest Lawn Memorial Park in West Covina. □

Charles "Chuck" McCaul, 81, retired foreman of the JPL welding shop, died of natural causes Jan. 15 at his home in La Crescenta.

McCaul joined JPL in 1948 and retired in 1985. He is survived by his daughter, Charleen Hicks, three granddaughters and three great grandchildren.

Services were held Feb. 5 at Forest Lawn Memorial Park in Glendale. □

Frank Wright, 66, an engineer in Section 320, died of stroke Jan. 26 at a local hospital.

Wright had worked at the Lab since 1964. He is retired by his wife, Kim Hue Wright; son Frank Wright III and daughter Tracy Henderson.

Memorial services were held Feb. 2 at Rose Hills Memorial Park in Whittier. □

Jesse Smith, 72, a retired senior engineer from Section 354, died of cancer Feb. 7.

Smith worked at the Lab from 1978-92. He is survived by his wife, Helen Leedham Smith, three children and four grandchildren.

Services were private. □

Howard Ross, 78, a retired Lab employee from Section 351, died of a heart attack Feb. 9.

Ross joined JPL in 1958 and retired in 1996. He is survived by his wife, Sue Thomas Ross, and daughters Laura and Amy.

Memorial services were scheduled for Feb. 20 at Kingdom Hall of Jehovah's Witnesses in Pasadena. Burial was private. □

Michael Gurrola, a retired member of the technical staff in Section 513, died of pneumonia Feb. 11.

Gurrola worked at the Lab from 1970-87. He is survived by his wife, Mary, daughter Michelle and son Paul.

Memorial services were held Feb. 16 at St. Anne's Church in North Hollywood. Burial was private. □

LETTERS

The family of Curt Carr would like to thank his friends, colleagues at JPL, Section 389 and the ERC for all the cards, letters, contributions and flowers received following his death. Curt will be missed, but knowing that he had so many friends at JPL is comforting.

Linda, Lindsey and Ashley Carr
□□□

The Weisbin family would like to express their deep appreciation for the kindnesses expressed by the JPL community at the passing of the mother of Chuck Weisbin. It is wonderful to know that we have such good friends.

The Weisbins (Daniel, Amy, Alison, and Chuck)
□□□

To all my friends at JPL: It is with mixed emotions that I bid all of you a fond farewell. After 13½ years, I have decided to call it quits to stay home with my children. So many of you have meant so much to me for so many years, that it was quite difficult for me to not return to work at the end of my second maternity leave. The projects I've been involved with over the years have been interesting and rewarding, as have the friendships. You are all a great bunch, and if I am truly lucky, I will work with you again one day. In the meantime, I hope that I am able to keep up connections through e-mail, phone calls, lunches off-Lab and an occasional visit with Neil. I wish you all continued success, particularly in the work you're doing now and that chooses you in the future. Very sincerely,

Vickere (Blackwell) Murphy

FOR SALE

AUDIO/VIDEO EQUIPMENT, used Peavey, 2 - T-300 high freq. projector, 12" woofer midrange horn tweeter, 1 - standard PA mixer amp 4 inputs, \$350 firm. 626/305-0886, Shirley.

BABY ITEMS, battery-operated swing w/3 speeds, \$40; car seat, \$5; playpen, \$35. 957-5502, Karen.

BASEBALL CARDS, 1 unopened box of Fleer Ultra '98, 24 unopened packs, 10 cards/pack; rookies, major players, Kerry Wood, Griffey Jr., Ripken Jr., McGwire, Piazza, Frank Thomas, Nomo, Sosa; FOOTBALL CARDS, 200 assorted, major players, rookies, inserts & Hall of Famers; tell me your favorite teams/players and they will be included, \$20. 626/914-6083.

BICYCLE, girl's blue Schwinn 10 speed, very good condition, \$50/obo. 626/965-1387, Lori.

CEMETERY LOTS, in Rose Hills, Whittier, 2 each, Terrace of Hope, Space 1 & 2, Lot 1043, \$2,300/each, total \$4,600; in

Forest Lawn, Covina Hills, veteran preferred, interment space 1 & 2, section honor, \$990/each, total \$1,980; we will take care of the transfer fees. 626/444-6691, Forrest Janes.

CHINA SET, 60 pieces for \$70/obo. 909/592-0780, Ana.

CIGARETTE CASES, sterling silver vintage and antique; various sizes, designs and makers, \$65-150. 310/399-4502.

COLLECTIBLES: 1910 wicker doll buggy, child's 1930s maple table with two bowed-back chairs, children's doll dishes and glassware, old handcrafted hardwood doll furniture, plus much more. 626/585-8213.

COMFORTER SET, twin, Walt Disney's Jasmine theme, includes flat & fitted sheet set w/one pillow case, ruffle, and comforter; also have the matching lamp w/shade, window valance and curtains; will negotiate any reasonable offer. 626/797-9846.

CRIB, white, excellent condition, includes mattress and bumper pad, \$60. 626/448-8809, Shary.

CROCK POT square by Rival with Corningware, \$15/obo. 626/568-8298.

DESK, large medium oak roll top, perfect condition, \$350. 805/527-7017.

DIET TAPES, Jenny Craig, set of 14, \$50. 790-3899.

DOG HOUSE, large igloo type, good cond., \$80. 626/969-8830, Eric, after 6:30 p.m.

DOGS, German shepard puppies looking for a good home, 5 females, both parents are full breed, mother on site, no papers, 6 weeks old 2/18/99, \$200 each. 626/969-7590.

DUMBBELLS, chromed handles, with weights, \$30. 352-3588.

ELECTRICAL WIRING, in 45-ft. lengths, red, black, white, new, \$40 for 180'. 249-6071.

EXERCISE MACHINE, Soloflex home gym with leg extension and butterfly attachments, \$500/obo. 626/301-7939, Anthony.

EXERCISE MACHINE, In-Stride Performer Exercise Walker, brand new, video and booklet, fully assembled, \$100. 352-2086.

FILING CABINET, 4-drawer/metal, letter size, \$35. 365-3799.

FILING CABINET, Harper Company, 4-drawer lateral, commercial grade, heavy duty steel, beige, 49" H x 42"L x 19"D, \$200. 213/617-2398.

FOOD PROCESSOR, CuisinArt, excellent condition, \$100 with blades. 626/798-0711.

FURNITURE, dinette, rattan round glass table, 42" diameter, four chairs (one with broken leg), baker's rack with three glass shelves, \$150/obo. 626/568-8298.

FUTON FRAME, double-size, folds into (low) couch, \$35; CD CAROUSEL, oak, two-tiered, holds 80 CDs, \$15; CARPET, white Berber hall runner, \$15; all excellent to vg condition. 626/794-8471.

GRANDFATHER CLOCK, "Howard Miller," 3-chime system, w/key drive, includes manual & maintenance kit, \$800. 249-6071.

GUITAR AMPLIFIER, Trace Acoustic TA-70CR 80-watt combo amp., 1 x 10" and 2 x 5" Celestion speakers; stereo chorus and spring reverb, 2-chan. input, minimal use in last 2 yrs., excellent condition; lists for \$1,500, sell \$400/obo. 760/244-3009, eves. after 6 p.m., Dan Kiewicz.

MOVING SALE: twin comforter, \$40/obo (paid \$70, 95% new); pillows (3), \$7/each/obo (95% new); fitted sheet, \$5/obo (95% new); twin bed \$20/obo (old); bicycle wheel, \$7/obo. 626/585-0038.

ORGAN, Yamaha 415 electronic console w/13 pedals, 3 key-boards, 144 rhythm patterns, pd. \$7,500, sacr. for \$3,000. 790-3899.

PERSONAL INFORMATION MANAGER, Seiko "Phone-Pal", \$25. 790-3899.

PIANO, Wurlitzer full console, medium oak cabinet, perfect condition, \$2,500. 805/527-7017.

PICTURE FRAMES, three made of brass, 22" x 28", \$7/each, \$18 for all three/obo. 626/568-8296.

PICTURES, 40" x 30", two tall-ship pictures taken by a professional photographer, vg condition, with frames; one of a Spanish tall ship in the SF Bay, one of a German tall ship taken near Puerto Rico; \$75/each, \$130 for both/obo. 626/568-8298.

POWER CENTER for computer, \$20. 790-3899.

PRINTER, Diablo 630 with print wheels, excellent condition, \$20/obo. 626/568-8298.

REFRIGERATOR, Whirlpool Limited Edition frostless, 18 cu. ft., equipped for auto ice maker, measures 31" w x 64" h, almond color, excellent condition, \$250/obo. 626/797-9846.

ROVERS, Mattel limited edition, 24K gold plated, mint in package, \$35. 626/791-0872.

RUG, 7' x 10' hand-tufted Chinese wool; colors: berry, tan & pale green; vg condition; estimated @ \$900, sell \$300/obo. 626/398-4960.

SANDWICH MAKER by Oster, makes two sandwiches, \$10/obo. 626/568-8298.

SOFTWARE, for Mac, all \$25 and under. 790-3899.

SOFTWARE, new Microsoft Publisher 98 (\$49), MS Picture it (\$19), Word 97 upgrade, Eudora 4.0 or Adobe Photo Deluxe (\$19); TREE, 6-foot fake ficus (\$19); CELL PHONE, Motorola, with case and charger (\$59), New hands-free kit for Nokia 2100 series cell phone (\$25), New NIMH extended life battery for Nokia 6160/6190 (\$39). 366-6134.

SPA, Hot Springs portable, seats 2- 4 comfortably, perfect for stress or back pain, new \$2,800, vg cond., \$800/obo. 626/355-5662.

SPRINKLER VALVE actuators, Lawn Genie model 756LG3/4, new, \$10 each. 790-3899.

Continued on page 8

SWEATER, Coogi, from Australia, new, sells in Nordstrom for \$325, \$100. 790-3899.

TABLE, dining room, round, mahogany, sits 8 with two extensions, almost new, comes with 6 matching chairs, \$650/obo; matching China buffet, \$950/obo; all for only \$1,400/obo. 909/592-0780, Ana.

TABLE, white wrought iron, glass top with 4 chairs, \$200. 790-3543.

TABLES, glass, four 2-shelf tables with brass feet, three make up a coffee table (one round 2.5-ft. dia., two "half-moon"), fourth is a round end table (2.5-ft. diameter), \$125/obo. 909/592-0780, Ana.

TENNIS RACKETS (3), two Head Prestige Tour Mid-Plus, brand new, \$150/each; one Head Trisys 270, \$100. 626/301-7939, Anthony.

TREADMILL, excellent condition, \$250. 626/798-8071.

TV, Sony, 53" big screen, black, excellent condition, approx. 18 months, seller need to move, \$1,500/ obo. 626/358-0823, Mariae Tagle.

VACATION, Mazatlan, Pueblo Bonito resort, Oct. 11-17, 7 nights, 1 bd., sleeps 6, on the beach, airfare not included, \$1,050. 626/917-0231.

VACATION CERTIFICATE for Hawaii, 4 nights accommodations in Oahu, good for 1-2 adults, airfare not included, expires June 30, \$200. 626/917-0231.

VIDEO GAME, Sega game system, 1 controller, 6 games, excellent condition; Batman Returns, Herzog Zwei, Joe Montana II Football, Super Hang-on, Sonic the Hedgehog, and John Madden Football; \$50. 626/797-9846, after 6 p.m.

WATCHES, vintage, good working condition; all types: Gruen, Bulova, Longines, etc., for men and women, \$50 and up. 310/399-4502.

WEDDING DRESS, excellent condition, used once, kept in garment bag; white straight dress with long sleeves, has bow in the back; must see, \$40/obo. 626/568-8298.

WINE RACKING, redwood, single-bottle depth, 6 ft. high by 12 ft. long, and 4 ft. high by 5 ft. long; will also include chiller unit, \$500. 626/355-8706.

WORKBENCH, Black & Decker Workmate, \$25; GRASS SHEARS, power, Disston, \$10. 352-3588.

VEHICLES / ACCESSORIES

'97 BMW Z3, Atlantic blue, tan top, chrome wheels, 2.8, manual 5-speed, 7k miles, \$32,500. 805/527-7017.

CAR RAMPS, heavy duty, 10-ton rated, knock-down design, new, \$40/pair. 249-6071.

'92 CADILLAC Seville, 60K miles, teal, leather interior, moon roof, CD player, \$14,200. 626/796-8423, Rich.

CHEVY LUV pickup, short bed, 4 speed, 4 cyl., custom rims/tires, great transportation, exc. work truck, new motor, \$1,000.

NOTICE TO ADVERTISERS

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Universe

Editor

Mark Whalen

Photos

JPL Photo Lab

Universe is published every other Friday by the Public Affairs Office of the Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109.

Advertising is a free service offered only to JPL, Caltech and contractor employees, retirees and immediate families.

Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to universe@jpl.nasa.gov. E-mail ads are limited to six lines.

Ads are due at 2 p.m. on the Monday after publication for the following issue.

To change an address, contact your section's administrative assistant, who can make the change through the HRS database. For JPL retirees and others, call Xerox Business Services at (626) 844-4102.

626/794-7281.

'91 DODGE Ram 50 LE sport truck, 101,000 miles, shell, bedliner, good sound, etc., yellow, \$5,000. 626/292-1760.

'95 FORD Explorer, Eddie Bauer 4 x 4 w/After Market stereo, CD & alarm syst., leather interior like new, 86,000 mi. w/100,000 transferable warr., exc. cond., \$17,800 firm. 800/937-9200, pager.

'90 FORD T-bird LX, 100K miles, gd. shape, \$2,500. 626/445-6100.

'79 FORD pickup, needs work, great for someone who fixes autos as a hobby. 626/797-9846, after 6 p.m.

'90 HYUNDAI Excel, white, fuel injection, a/c, 64,000 miles, \$2,200. 626/564-8476.

'93 JEEP Wrangler Sport Utility 2D 4WD, exc. cond., 5-spd. manual trans., 4.0L inline 6 cyl., soft-top, blue two-tone paint, running boards, pwr. steering & brakes, tilt wheel, AM/FM cass. stereo, premium sound package, locking trunk, alarm w/microwave proximity sensor, 55k miles, \$9,500/obo. 626/398-6356.

'94 MAZDA Miata, black, 56K miles, 5-spd, air, CD, \$8,450/obo. 504-4905.

'93 MAZDA Miata, red, 58K miles, ABS, auto, air, \$6,850/obo. 768-1612.

'93 MAZDA Protégé, 70,000 miles, \$5,800/obo. 626/447-4028.

'89 PONTIAC Grand Am SE, quad 4 eng., auto, a/c, pwr windows/locks, am/fm/cass., orig. owner, \$4,000/obo. 323/255-1106.

PONTIAC Grand Prix, \$2,500. 626/798-8071.

'88 TOYOTA Celica FX convertible, white with gray upholstery; clean, very well-maintained; 5-speed manual; A/C, AM/FM cassette, cruise control, power windows, custom installed Viper alarm; 75,500 miles; \$5,900/obo. 548-9151.

'85 TOYOTA Camry LE, 4-dr., auto, power, 95k miles, clean, good cond., most service records, \$2,000 firm. 626/794-9416.

'62-'74 VW instr. gages, Steward/Warner, for oil, vacuum, volts, amps, tachometer; all are back-lite; like new; \$175 for all. 249-6071.

FREE

COMPUTER, 286 with monochrome monitor, floppy, modem, semi-functional hard drive. 626/351-5485.

DOG, female pug, 1 year old, to good home. 626/403-9049.

WANTED

APARTMENT or room with kitchen privileges for Australian scientist, early March-early July, prefer Pasadena near 177 bus line. 626/797-7175, George.

CAREGIVER/COMPANION for elderly woman, approx. 4 hrs. per day, no lifting or walking assistance required. 626/791-9270.

COMPUTER MONITOR, Mac-compatible (View-sonic, Sony, Apple,...), 15-inch or larger. 626/351-0182, Mike.

LAWN MOWER, must be in great condition. 626/292-1760.

PERSONAL TRAINER for JPL couple, eves. 626/794-6860.

ROOM IN HOUSE, located in W. San Gabriel or Glendale, unfurnished, w/backyard for \$450 including utilities; also accept small housetrained basset hound, who remains outside during the day, inside when I am home; private ba., full use of house privilege, washer/dryer, etc.; need to move ASAP. 626/301-0132, Rani Kamaga.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.

LOST & FOUND

Lost: CLASS RING, 1971 Washington University, "RWA" inside band. Call ext. 4-3996.

FOR RENT

ALTADENA, 3 bd., DR, f/p in LR, built-ins, security system, lg. garage, 6 min./JPL, quiet cul-de-sac, privacy; \$1,300, negotiable. 626/798-9244.

ALTADENA, master bd. with priv. ba. & balcony w/view, off-st. priv. parking, pool & Jacz., big front/back yd., 4 miles/JPL, share w/roommates, \$600. 626/794-7281.

ALTADENA, (north west), next to mtns., 2 sep. rms. in beautiful house, secure and lovely surroundings, very close to Arroyo Seco cyn.; ea. rm. \$400, util. incl.; ba. to share, \$400 dep. 626/797-1374, Monique.

GRANADA HILLS, seeking 1 person to share lg. remodeled home; gardener, c/a, cable, fireplace, hardwood floors, recessed lighting, patio, BBQ, new appliances, washer/dryer, spa and office; rm. has 2 windows, recessed lighting w/dimmers, attached ba.; beautiful home is north of Rinaldi, only 20 minutes from JPL; \$495 + ½ utilities + deposit; no smoking, no pets. 366-6134.

LA CRESCENTA, guest quarters w/private entrance & parking (2); 1-bd. suites incl. living rooms, full ba., din. rooms, min. kitchen fac., priv. patios & laundry, cent. a/c, all utilities & cable, shared cost; lg. suite \$850, small \$650. 957-2173.

MONTEREY HILLS (outside S. Pas.) condo, bright/airy, priv. end unit on 3rd flr. w/great view, 2 bd., 1 ba., sep. vanity area, hwd. floors, frplc., cathedral ceiling, cent. air/heat, balcony, stove, dishwasher, garb. disposal, cable, some util., pool, laundry rm. for w/d in unit (or use of Indry. facil. on 3rd flr.), security bldg., sec. parking (2 spaces), close 110 frwy. access, 10 min./JPL, avail. 2/22, \$1,000. 626/296-9073.

NE PASADENA, quiet, unfurnished rear studio, good location, a/c, utilities included, no pets, \$475. 626/791-7130.

PASADENA apt. to share, 3 bd., 3 ba., fully furn., patio, parking space, laundry facility, close to PCC & Caltech, \$400 + sec. dep. + 1/3 util., avail. March 20. 626/351-9641.

PASADENA apt., 2 bd., 2 ba., cent. air/heat, small patio, laundry facil., stove, carport, close to PCC/Caltech, \$825 + util. 626/351-9641.

PASADENA home for lease, Bungalow Area nr. Caltech & JPL, 3 bd., 2 ba., lg. kitch., lots of storage, laundry hook-ups, living rm. w/fireplace, din. rm. w/sun room area, hardwood floors, patio, dbl. garage, enclosed backyard, fruit trees, \$1,100. 626/794-0455, after 6 p.m.

SAN GABRIEL VALLEY home to share, 4 bd., 1/2 utilities, non smoker, no pets, 25 min. southeast of Pasadena, \$400. 626/935-1387, L. Sams.

SOUTH PASADENA, furnished studio apartment, 1718 Huntington Dr. between Marengo and Milan, units on one-level, parking space, laundry facilities, utilities paid, on bus lines, convenient shopping, non-smoker, no pets. 626/792-9053, Marilyn.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry room, \$129,000. 909/585-9026.

IDYLVILD mtn. home, 2 bd. 1 ba., located on 0.6 acres, great view of Garner Valley, large deck, \$76,500. 626/798-1574.

PALM DESERT, exquisite, 2 bd., 2 ba. villa for vacations or long term, newly remodeled, w/skylight, patio & 2-car garage; located across the Living Desert, great private, secure resort w/ tennis cts., multiple pools & spas and clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.

VACATION RENTALS

BIG BEAR cabin, cozy, quiet area, walk to village, 2 bd., slps. 8, compl. furn., F/P, TV/VCR, \$75/night. 249-8515.

BIG BEAR, 7 mi. from slopes; full kitch., f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night min., no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.

BIG BEAR CITY, 4 miles from ski slopes, 2 bd., 1 ba. cabin, nicely furnished, sleeps 8, fireplace, TV, full kitchen, microwave; \$100 refundable cleaning deposit; \$75/night weekdays, \$250 for weekend (2 nites). 909/982-2986.

BIG BEAR LAKE cabin, near ski area, lake, shops, village, forest, 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more, JPL disc. price from \$65/night. 909/599-5225.

BIG BEAR LAKEFRONT lux. townhome, indoor pool/spa, nr. skiing, beaut. master bdrm. suite, slps. 6. 949/786-6548.

CAMBRIA, ocean front house, exc. view, sleeps up to 4, \$125 per night for 2, \$175 per night for 4. 248-8853.

HAWAII, Kona, on 166 ft. of ocean front on Keauhou Bay, priv. house and guest house comfortably slp. 6; 3 bd., 2 ba., swim, snorkel, fish; spectac. vws., nr. restaur., golf, other attrac. 626/584-9632.

HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microw., dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: \$95/night/2, 12/15-4/14 rate: \$110/night/2, \$10/night/add'l person. 949/348-8047.

MAMMOTH condo, walk to ski lifts, 3 bd., 3 ba., beaut. furn.; special midweek rate for JPLers. 626/794-6860, eves.

MAMMOTH condo in Chamonix at lifts 7, 8, 16, 17; walk to Warming Hut, 2 bd., 2 full ba., slps. 6, fully eqpd. elec. kitch., microw. & extras, frplc/wood, color TV, VCR, FM stereo, o/d Jacz., sauna; gm., rec. & Indry. rms., walk to shops, lifts; spec. midwk rates. 249-8524.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft; sleeps 6-8; fully eqpd kitch. incl. microwave, D/W; cable TV, VCR, phone, balcony w/view to mtns., Jacz., sauna, streams, fishponds; close to Mammoth Creek; JPL discount. 626/798-9222 or 626/794-0455.

OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier/harbor, pool, spa, game rm., slps 4. 949/786-6548.

PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitchen w/microw., beaut. furn., close to golf, beaches, 17 Mile Drive, Aquarium, Cannery Row, JPL disc. 626/441-3265.

PALM DESERT, exquisite, 2 bd., 2 ba. villa for vacations or long term, newly remodeled, w/skylight, patio & 2-car garage; located across the Living Desert, great private, secure resort w/ tennis cts., multiple pools & spas and clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.

PALM SPRINGS condo, 1 bd., compl. furn., pool, spa, tennis, cable TV, VCR; carpets, paint, cooking utensils new; rent daily, weekly, weekends, monthly. 626/445-0884.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/794-3906.

S. LAKE TAHOE Keys waterfront home, 4 bd., 3 ba., slps. 12+, 2-leve. frplacs, decks overlk. priv. dock/ski lifts, gourm. kitch., bikes, boats, color TVs, VCR, ster. w/tape/disk, pools, hot tub & bch.; tennis, 10 min./skiing, casinos/golf, 1 hr./wine cntry; \$995/wk. hi seas. [15 June to 15 Sept; 22 Nov. to 1 March]; + \$90 clean fee; 3-day min. 626/578-1503, Jim Douglas.